Claims

[Claim 1]

A method for producing a catalyst for the production of α,β-unsaturated carboxylic acid using molybdenum oxide as a molybdenum raw material,

wherein the molybdenum raw material is a molybdenum oxide in which the proportion of particles having a particle diameter of 6μm or less is 2 to 55% by volume in a frequency distribution curve obtained by particle size distribution measurement,

and wherein the method comprises the steps of:

(i) heating an aqueous slurry (I) obtained by mixing water with a catalyst raw material containing at least said molybdenum raw material and phosphorus raw material to a temperature of 90 to 150°C to obtain an aqueous slurry or aqueous solution (II) containing a heteropolyacid;

(ii) adding a metal cation-contain compound to said aqueous slurry or aqueous solution (II) to obtain an aqueous slurry (III) in which a heteropolyacid salt is precipitated;

(iii) drying said aqueous slurry (III) to obtain a catalyst precursor dried product; and

(iv) heat treating said catalyst precursor dried product to obtain a catalyst;

wherein a duration time in which temperature of said aqueous slurry (I) reaches from 60°C to 90°C in step (i) is 5 to 40 minutes.

[Claim 2]

The method for producing a catalyst for the production of α,β-unsaturated carboxylic acid according to claim 1,

wherein the duration time in which temperature of said aqueous slurry (I) reaches from 60°C to 90°C in step (i) is 7 to 30 minutes.

[Claim 3]

The method for producing a catalyst for the production of α,β-unsaturated carboxylic acid according to any one of claims 1 to 2,

wherein the molybdenum raw material is a molybdenum oxide in which the proportion of particles having a particle diameter of 6μm or less is 2 to 35% by volume.

[Claim 4]

The method for producing a catalyst for the production of α,β-unsaturated carboxylic acid according to claim 3,

wherein the molybdenum raw material is a molybdenum oxide in which the proportion of particles having a particle diameter of 6μm or less is 2 to 15% by volume.

[Claim 5]

The method for producing a catalyst for the production of α,β-unsaturated carboxylic acid according to any one of claims 1 to 4,

wherein the catalyst has a composition represented by the following formula (1)

$P_aMo_bV_cCu_dA_eE_fG_gO_h$ (1)

wherein P, Mo, V, Cu, and O are elemental symbols representing phosphorus, molybdenum, vanadium, copper, and oxygen, respectively; A represents at least one element selected from the group consisting of antimony, bismuth, arsenic, germanium, zirconium, tellurium, silver, selenium, silicon, tungsten and boron; E represents at least one element selected from the group consisting of iron, zinc, chromium, magnesium, calcium, strontium, tantalum, cobalt, nickel, manganese, barium, titanium, tin, lead, niobium, indium, sulfur, palladium, gallium, cerium and lanthanum: G represents at least one element selected from the group consisting of lithium, sodium, potassium, rubidium, cesium and thallium; a to h represent atomic ration of each element; when b=12, a=0.5 to 3, c=0.01 to 3, d=0.01 to 2, e=0 to 3, f=0 to 3 and g=0.01 to 3 and h is the atomic ratio of oxygen required to satisfy the valence of each of the above elements.

[Claim 6]

The method for producing a catalyst for the production of α,β-unsaturated carboxylic acid according to any one of claims 1 to 5,

wherein 50 mass % or more of molybdenum trioxide is used as the molybdenum raw material.

[Claim 7]

The method for producing a catalyst for the production of α,β-unsaturated carboxylic acid according to claim 6,

wherein 70 mass % or more of molybdenum trioxide is used as the molybdenum raw material.

[Claim 8]

The method for producing a catalyst for the production of α,β-unsaturated carboxylic acid according to any one of claims 1 to 7,

wherein the catalyst for the production of α,β-unsaturated carboxylic acid is a catalyst used in the production of α,β-unsaturated carboxylic acid by gas phase catalytic oxidation of α,β-unsaturated aldehyde with molecular oxygen, wherein the α,β-unsaturated aldehyde is (meth)acrolein and the α,β-unsaturated carboxylic acid is (meth)acrylic acid.

[Claim 9]

A method for producing an α,β-unsaturated carboxylic acid,

wherein a catalyst for the production of α,β-unsaturated carboxylic acid is produced by the method according to any one of claims 1 to 8, and an α,β-unsaturated carboxylic acid is produced by gas phase catalytic oxidation of α,β-unsaturated aldehyde with molecular oxygen using the catalyst.

[Claim 10]

A method for producing an α,β-unsaturated carboxylic acids,

wherein the α,β-unsaturated carboxylic acid is produced by gas phase catalytic oxidation of α,β-unsaturated aldehyde with molecular oxygen using a catalyst for the production of α,β-unsaturated carboxylic acid produced by the method of any one of claims 1 to 8.

[Claim 11]

A method for producing an α,β-unsaturated carboxylic acid esters, by esterifying the α,β-unsaturated carboxylic acids produced by the method of claim 9 or 10.

[Claim 12]

A method for producing an α,β-unsaturated carboxylic acid ester,

wherein an α,β-unsaturated carboxylic acid is produced by the method of claim 9 or 10, and said α,β-unsaturated carboxylic acid is esterified.